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Specification and Drawings, as originally filed, with Application for Patent Serial No:  
2,463,238, on April 5, 2004, by **PETER KLAPTCHUK**, for "Treatment of Biomedical  
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**TREATMENT OF BIOMEDICAL WASTE:**

This invention is in the field of waste treatment and in particular in the treatment and disposal of biomedical waste products.

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**BACKGROUND:**

10 Within the medical field, and especially in hospital environments, controlling the spread of potentially pathogenic organisms is an important concern. A number of studies have shown that the risk of infection due to the spread of disease organisms is a serious human health problem. Infections can be transferred by contact with surfaces upon organisms can be deposited by handling by patients or hospital staff, or by airborne dispersion after a cough or sneeze. The risk of infection is further exacerbated by the confined space of  
15 typical hospitals, and by the fact that people in hospitals may have an impaired ability to resist infection due to their own health problems. In some cases as well, the infectious organisms are sometime resistant to commonly used antibiotics, so called super-bugs, and so remediation of the infection through medical intervention may be difficult, if not impossible.

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As a result, it is common practice in modern day medical setting to take appropriate measures to reduce the risk of infection. Such measures include hand washing after

## Page 2

contact with patients, frequent cleaning of floors, walls and furniture with disinfecting solutions, and the use of disposable products. The use of disposable plastic syringes, cutlery and beverage containers are but a few examples of products designed for single use in order to reduce the risk of spreading pathogens.

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However, despite the long-established use of disposables, a recent trend has developed towards re-using some medical products such as sharps disposal containers, after they have been ostensibly cleaned and sterilized in order to remove and inactivate any disease organisms that might be present. One problem with this practice is that unless  
10 sterilization is absolute there is risk of reintroducing to the hospital environment the very organisms that one is trying to remove. Another problem with current methods of disinfection is that they sometimes use harsh chemical treatments in order to destroy the infectious agent. These chemicals, being themselves toxic, pose added risks to those whose responsibility it is to handle biomedical wastes, as well as a risk to the  
15 environment upon their disposal. The alternative to disinfection, removal of waste from the hospital by disposing of untreated wastes in landfills or elsewhere, is equally untenable as disposing of untreated biomedical waste is typically banned.

An additional health hazard is posed by the handling and disposal of biological wastes.  
20 These biological wastes can comprise such things as blood and blood products, tissues resected tissue during surgery, as well as single use items used and discarded in the normal course of surgical procedures. It is now well-recognized that contact to human

fluids such as blood is a significant risk factor in the spread of the human immunodeficiency virus (HIV) that causes the disease acquired immune deficiency syndrome (AIDS). At present surgical wastes are disposed of by methods such as incineration, or by heat sterilization on a batch-by-batch basis using autoclaves.

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Each of these methods, and especially incineration, require significant amounts of energy, and so increase the operating costs for facilities like hospitals and surgical clinics. In addition, incineration poses a further risk to the environment with the release of the by-products of combustion. Despite these costs though, surgical facilities must treat  
10 biological wastes effectively, as has already been discussed most sanitary landfills and other waste disposal facilities ban the deposit of untreated biomedical wastes for the obvious reason that to permit such activities could lead to the uncontrolled spread of pathogens in the environment.

- 15 There are other methods of sterilization that overcome some of the problems associated with prior art methods of disinfection such as chemicals, incineration or autoclaving and the like. The use of ozone is well known as having disinfecting properties, and thus has been used as an alternative way in which to inactivate pathogens. Ozone is a chemically active radical species of oxygen, commonly produced by ionization of either air or pure  
20 oxygen. Commercial ozone generators are available which can use readily compressed oxygen as the starting material for the production of significant amounts of ozone at relatively low cost. Ozone is well known as a sterilizing agent, and the use of ozone is

Page 4

considered safe as evidenced by the approval of the U.S. Food & Drug Administration for use in treating food products.

5 Despite the advantages of ozone as a sterilizing agent, current equipment that makes use of ozone for treating waste limit the application of this method of sterilization. Present ozone sterilizers are manually operated, single batch machines that lack the ability to continually process biomedical wastes as it is produced, and are thus not adapted to large-scale continuous flow waste disposal operations as would exist in hospitals or large surgical clinics. Thus, an operator has to continually load and unload wastes into the  
10 sterilizer. Not only does this reduce the amount of waste that can be processed with in a given time, but increases the risk of exposing the waste handler to disease organisms.

15 **SUMMARY OF THE INVENTION:**

It is an object of the present invention to provide an apparatus for the treatment of biomedical waste that is an improvement on current methods of biomedical waste treatment and disposal.

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It is a further object of the present invention to provide such an apparatus for the treatment of biomedical waste that overcomes problems in prior art methods and

Page 5

apparatus.

It is a further object of the present invention to provide such an apparatus that is relatively easy to install and which is relatively inexpensive to operate.

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It is a further object of the present invention to provide an apparatus that allows for the substantially automated and continuous treatment of biomedical waste.

10 It is a further object of the present invention that biomedical waste treated with the apparatus will be essentially free from pathogens, and as such safe for disposal in municipal landfills and the like.

15 The invention provides, in one embodiment, an apparatus that comprises a hopper, and airlock, a processing chamber and a source of ozone. Waste materials to be processed are loaded into the hopper. A shredder reduces the size of the material making the waste easier to handle and more adapted to sterilization by increasing the degree of contact with ozone. Ozone from an ozone generator is injected into the processing chamber containing the waste. An agitator mixes the waste in the presence of the ozone such that essentially all of the waste material comes into contact with the ozone. After a predetermined time, the material, now essentially sterilized, is conveyed to a disposal tank. When full of treated waste the disposal tank can be replaced with an empty tank and the process continued. The

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Page 6

full tank can be removed and the contents, now safely sterilized, disposed of in a sanitary landfill or other like disposal site.

Conveniently the process can be automated by the inclusion of sensors and control mechanisms. The sensors operate to provide information about ozone levels in the processing chamber, or to indicate when the hopper is full or when the treatment process is complete and another batch of material can be safely added to the processing chamber. Inclusion of a timer mechanism permits an operator to vary the length of time of the treatment process.

The invention may further comprise ozone-filtering devices to prevent the escape of ozone into the area surrounding the apparatus. Alternatively, or in addition to ozone filters, fumes from the processing chamber may also be conveniently vented to a fume hood or to rooftop outlets where the vapors are rapidly diluted in the atmosphere, as is common practice in the disposal of vapors.

**DESCRIPTION OF THE DRAWINGS:**

While the invention is claimed in the concluding portions hereof, preferred embodiments are provided in the accompanying detailed description which may be best understood in



Page 7

conjunction with the accompanying diagrams where like parts in each of the several diagrams are labeled with like numbers, and where:

5 Fig. 1 is a perspective view of an embodiment of the invention for the treatment of biomedical waste.

Fig. 2 is an exploded perspective view of the embodiment of Fig. 1.

10 Fig. 3 is a schematic side view of the embodiment in Fig. 1 showing an agitator.

**DETAILED DESCRIPTION OF THE ILLUSTRATED EMBODIMENTS:**

The present invention comprises an apparatus that is used to treat biomedical waste, such  
15 that the waste is safe for disposal in sites such as sanitary landfills. In one embodiment, the apparatus comprises a hopper 1 into which untreated waste is placed. The hopper includes an airlock 3 which can be closed when the material in the hopper reaches a pre-determined level. With the airlock closed, the materials in the hopper are no longer in contact with the atmosphere. The airlock 3 further serves to prevent the escape of  
20 materials, fumes vapors and the like from within the hopper 1 or the processing chamber 5. Conveniently, an indicator 7 can be included which informs the operator of the waste treatment system that the hopper is full. The indicator may comprise a visible or audible

Page 8

warning or a combination of the two. Alternatively, an internal sensor may be included which is calibrated to close the airlock when the contents of the hopper 1 reach a predetermined level. The apparatus may further comprise a lift 29, such as hydraulic or mechanical lift, which permits waste containers to be hoisted up to the opening in the top of the hopper 1, and the contents dumped into the hopper 1 without the need for manual handling of the waste.

With the hopper 1 full, and the airlock 3 closed, a processing chamber door 9 is opened to allow the materials to move from the hopper 1 into the processing chamber 5. Conveniently, the apparatus also includes a shredder 11, which grinds the waste material as it moves from the hopper 1 into the chamber 5. Grinding provides the advantage of improving the access of the ozone to the entirety of the material being processed.

Once the material is within the processing chamber 9, the processing chamber door 11 is closed effectively sealing off the processing chambers 9 from the outside. The sealing feature permits the maintenance of high ozone levels within the chamber, such that substantially all biological organisms that may be present in the waste material will be effectively inactivated. Sealing the processing chamber prevents the release of ozone into the surrounding atmosphere. As ozone is toxic to humans, controlling the release of ozone by the apparatus is important to ensure the safety of the operator, or those who may happen to be in the area of the apparatus while it is in operation.

To provide for even access for ozone to all the waste material being treated, the processing chamber 5 may further comprise an agitator 13. The agitator 13 provides a mixing function such that substantially all the waste material in the chamber 5 will come into contact with ozone during the treatment process.

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Once the waste materials are in the processing chamber 5, and the chamber door is sealed, ozone is injected into the chamber 5. An ozone generator 15 provides ozone, which is injected into the chamber 5. Conveniently, the ozone generator may be adapted to use either commercially available portable compressed air or oxygen cylinders, or  
10 where available, piped in hospital breathing air or oxygen, as the oxygen source 17. Some commercially available ozone generators also have the ability to extract oxygen from ambient air for ozonation, and as such do not require any special oxygen supply. Such devices would be readily adaptable to the apparatus.

15 The apparatus further comprises ozone sensors 19 such that the ozone levels in the chamber 5 can be monitored. The output from the ozone sensors 19 is sent to a control mechanism, which in turn varies the amount of ozone that will be injected into the chamber 5 from the ozone generator 15. The apparatus further comprises a timer mechanism, such that waste materials may be treated for a period of time that can be pre-  
20 determined by an operator. The length of time can be thus be varied, such that different types of pathogens that may be present in waste, and which may be more or less resistant to inactivation, can be effectively inactivated during the ozone sterilization process.

Based on previous studies well known in the art, it will be readily determinable as to what lengths of time will be appropriate to achieve the goal of process, namely the inactivation of substantially all pathogens that may be present in the waste. The outputs from sensors and the timer and other desired controls may be included in a control panel  
5 31, conveniently placed for use by an operator.

Once the waste material has been treated for the desired time, a second processing chamber door 21, is opened. Conveniently, the processing chamber 5 further comprises the function of a trash compactor, the operation of which is well known in the art, and so  
10 when the second processing chamber door 21 is opened, the treated waste materials are pushed from the chamber 5 into a disposal container 23. The disposal container, which now contains treated waste materials, can then be transported to disposal sites such as a sanitary landfill, and the contents, now sterilized, can be disposed of without fear of harm to either humans or the surrounding environment. In an alternative embodiment the  
15 chamber 5 other mechanisms for moving the waste materials from the chamber 5 to the disposal container 23, such as conveyor belts or augers known in the art, could also be used with the apparatus, and all such mechanisms are intended to be encompassed by the scope of the invention.

20 As ozone is a toxic substance, the apparatus further includes an activated carbon filter 25, which absorbs ozone from the atmosphere within the chamber 5 upon completion of a treatment cycle, so that ozone is not released into the environment. Other types of ozone

Page 11

sequestering filters are also known in the art, and the invention is intended to encompass the use of these other types of filters as alternatives to activated carbon filters. As further protection to the environment, the apparatus further comprises a vacuum outlet 27, which may be used to safely vent ozone and other fumes through a fume hood or other similar  
5 type of apparatus well known in fields where toxic fumes or other volatile substance must be safely vented or otherwise released into the atmosphere.

The foregoing is considered as illustrative only of the principles of the invention. Further, since numerous changes and modifications will readily occur to those skilled in  
10 the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly, all such suitable changes or modifications in structure or operation which may be resorted to are intended to fall within the scope of the claimed invention.

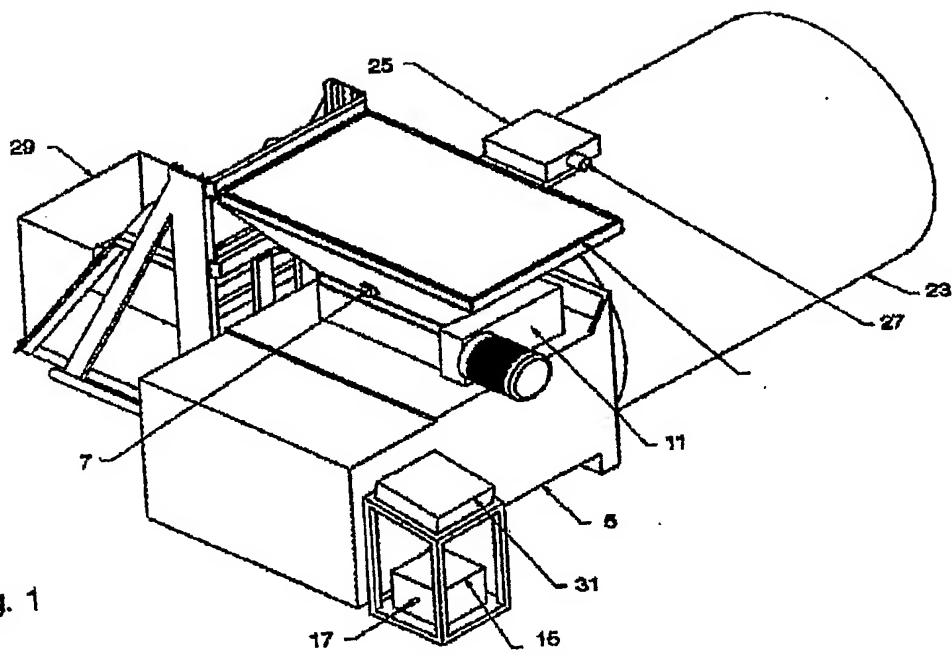


Fig. 1

Fig. 2

